

PATENT

Atty. Dkt. No. APPM001717.D2.Y1/PPC/ECP/CKIM

IN THE CLAIMS:

Please add new claims 27-30 as follows:

1. (Previously Presented) A method for annealing a copper layer, comprising:
forming the copper layer on a substrate by electroplating in a first chamber of an integrated processing system;
rinsing the substrate in a cleaning station of the integrated processing system;
treating the copper layer in a gas environment in a second chamber of the integrated processing system, wherein the gas environment comprises nitrogen (N₂) and hydrogen (H₂); and
bringing the substrate in proximity to a cooling plate to cool the substrate to a temperature below about 100°C.
- 2-4. (Canceled)
5. (Previously Presented) The method of claim 1, wherein the hydrogen is present at a concentration of less than about 4% in the gas environment.
6. (Original) The method of claim 5, wherein the copper layer is treated for a time duration less than about 5 minutes.
7. (Previously Presented) The method of claim 6, wherein the copper layer is treated at a temperature of between about 200 to about 500°C.
8. (Original) The method of claim 7, wherein the gas environment comprises less than about 100 parts per million of oxygen.
9. (Previously Presented) The method of claim 8, wherein the gas environment comprises a pressure of 760 torr.

PATENT

Atty. Dkt. No. APPM/001717.D2.Y1/PPC/ECF/CKIM

10. (Canceled)
11. (Previously Presented) A method of annealing a copper layer, comprising:
forming the copper layer on a substrate by electroplating in a first chamber of an integrated processing system;
rinsing the substrate in a cleaning station of the integrated processing system;
treating the copper layer in a gas environment at a temperature of between about 200 to about 500°C for a time duration of less than about 5 minutes in a second chamber of the integrated processing system; wherein the gas environment comprises nitrogen (N₂) and hydrogen (H₂); and
bringing the substrate in proximity to a cooling plate to cool the substrate to a temperature below about 100°C.
12. (Previously Presented) The method of claim 11, wherein the temperature is about 250°C.
13. (Original) The method of claim 12, wherein the gas environment further comprises less than about 100 parts per million oxygen.
14. (Previously Presented) The method of claim 13, wherein the gas environment comprises a pressure of 760 torr.
- 15-20. (Canceled)
21. (Previously Presented) The method as claimed in claim 1, wherein the substrate is cooled to a temperature below about 80°C.
22. (Previously Presented) The method as claimed in claim 1, wherein the substrate is cooled to a temperature below about 50°C.

PATENT

Atty. Dkt. No. APPM001717.D2.Y1/PPC/ECP/CKIM

23. (Previously Presented) The method as claimed in claim 1, further comprising maintaining the cooling plate at a temperature of about 5°C to about 25°C.
24. (Previously Presented) The method as claimed in claim 11, wherein the substrate is cooled to a temperature below about 80°C.
25. (Previously Presented) The method as claimed in claim 11, wherein the substrate is cooled to a temperature below about 50°C.
26. (Previously Presented) The method as claimed in claim 11, further comprising maintaining the cooling plate at a temperature of about 5°C to about 25°C.
27. (New) A method of annealing a copper layer, comprising:
forming the copper layer on a substrate by electroplating in a first chamber of an integrated processing system;
rinsing the substrate in a cleaning station of the integrated processing system;
treating the copper layer in a gas environment at a temperature of between about 200 degrees Celsius to about 500 degrees Celsius for a time duration of less than about 5 minutes in a second chamber of the integrated processing system; wherein the gas environment comprises a hydrogen containing gas; and
bringing the substrate in proximity to a cooling plate to cool the substrate, wherein the treating the copper layer and the bringing the substrate in proximity to a cooling plate occur within the same chamber.
28. (New) The method of claim 27, wherein the hydrogen containing gas comprises a gas selected from the group consisting of hydrogen and ammonia.
29. (New) The method of claim 1, wherein treating the copper layer and bringing the substrate in proximity to a cooling plate occur within the same chamber.

PATENT

Atty. Dkt. No. APPW001717.D2Y1/PPC/ECP/CKIM

30. (New) The method of claim 11, wherein treating the copper layer and bringing the substrate in proximity to a cooling plate occur within the same chamber.